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DOT'S BUDGET

Safety, Management, and Other Issues Facing the Department in Fiscal Year 1998 and Beyond

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Mr. Chairman and Members of the Subcommittee:

When we testified before you last year, we pointed out that the Department of Transportation (DOT) faced tremendous challenges in ensuring the safe and efficient movement of people and goods and a cost-effective investment in the nation's transportation infrastructure, including its highways and transit systems, airports, airways, ports, and waterways. If anything, the obstacles to meeting the challenges have increased primarily because efforts to improve the safety and security of our aviation system will stretch limited resources even further. At the same time, the demand for scarce federal funds for other transportation programs and the continuing pressures to reduce the federal budget have not abated. The \$38 billion proposed in DOT's fiscal year 1998 budget represents about a 1-percent reduction from this year's enacted appropriation. Funding constraints intensify the need for the Department to improve its management and oversight processes to ensure that the American people are getting the most out of their transportation investment dollars.

My testimony today, based on our recently completed and ongoing work, will discuss the major safety and security, management, and other issues facing the Department. In summary, we found the following:

Safety and Security Issues

- Crashes of ValuJet Flight 592 and TWA Flight 800 have heightened concerns about the safety and security of our aviation system. Over the years, we have reported on problems with the Federal Aviation Administration's (FAA) oversight, including the need to (1) target limited inspection resources, (2) improve the reliability of safety data, (3) improve inspector training, and (4) address the security vulnerabilities of our air transportation system. Our recent reports and testimonies on new airlines and aviation security have reiterated the need for improvements in these areas.

Recently completed aviation studies by a presidential commission and FAA have also concluded that major problems need to be addressed to improve the safety and security of the aviation system. The Congress has also specified that FAA's primary role is safety and has appropriated more funds to hire and train inspectors and procure explosive detection systems for the nation's airports. However, key issues that have yet to be addressed are how much more all the improvements will cost and how they will be funded. In addition, FAA needs a comprehensive strategy to guide the implementation of recommendations made in the various aviation studies.

This strategy could serve as a mechanism to track progress and establish the basis for determining funding trade-offs and priorities, but its successful implementation will require strong, stable leadership at FAA and the Department.

- Major opportunities exist to improve the safety of our surface transportation system by reducing the more than 40,000 fatalities each year on our nation's highways. The National Highway Traffic Safety Administration (NHTSA) estimates that if all vehicle occupants used seat belts, 10,000 lives and \$20 billion could be saved each year, and injuries to 200,000 people could be avoided. Recent concerns about the potential hazards of air bags in certain situations intensify the importance of using seat belts. Furthermore, from January through November 1996, federal and state officials carried out more than 20,000 inspections of trucks entering from Mexico resulting in about 45 percent of the vehicles being placed out of service for serious safety violations. Our ongoing work shows that, while the number of truck inspectors at major southern border crossings has increased and two large permanent inspection facilities have been opened, the results of increased inspections do not show a clear trend that Mexican trucks are becoming safer. In addition, we are reviewing other opportunities to improve large truck and rail safety.

Management Issues

- Another primary role of DOT is to ensure that federal transportation funds for aviation, highway, and transit programs are spent effectively and efficiently so that the nation gets the most value for its transportation dollars. To that end, our work over the years has identified numerous ways in which FAA can improve the management of its multibillion-dollar air traffic control (ATC) modernization program. Most major modernization projects have been plagued by cost overruns, schedule delays, and shortfalls in performance. FAA needs to adopt a complete systems architecture for its modernization program, improve its cost estimating and cost accounting processes, apply more discipline in its software acquisitions for the program, and broaden its efforts to reform its organizational culture to include stakeholders from across the agency.
- In addition, the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) can work with states and transit operators to enhance their ability to more effectively manage the costs of and acquire financing for large-dollar surface transportation projects.¹ For example, while FHWA's oversight of large-dollar projects is not intended to focus on

¹The surface transportation projects we discuss in this testimony all cost over \$1 billion, but defining large-dollar projects for an individual state or transit operator is relative to their size and resources.

cost containment, we believe that the agency can do more to share states' best practices in this area to promote more effective and efficient use of limited federal and state highway dollars and control cost growth that can adversely impact the funding for other projects. Furthermore, financing large transportation projects has become increasingly complicated as the transportation community has become more active in seeking financing through bonds, local contributions, and innovative federal financing, such as loans. We found that costs on the projects we reviewed continue to grow, and FHWA and FTA need to help ensure that the projects are able to secure firm commitments for all of the funding needed to finance them. If not, the federal, state, and/or local stakeholders could be asked to pay more for the projects or their timely completion could be jeopardized.

- The Intelligent Transportation System (ITS) is a collection of computer and telecommunications systems intended to improve surface transportation safety and efficiency. After 7 years and \$1.3 billion in federal funding, DOT's vision for widespread deployment has not been realized. This is due to a number of obstacles, including a lack of technical expertise and knowledge about ITS among state and local officials, a lack of data demonstrating the benefits of ITS technologies, and limited funding available for ITS in light of other investment priorities. In its fiscal year 1998 budget, DOT is proposing to focus federal funds on deploying ITSS. However, before DOT can aggressively pursue widespread deployment it must help state and local officials overcome these obstacles.
- In prior testimony before this Subcommittee, we stated that DOT could potentially save millions of dollars by taking advantage of opportunities to consolidate and/or "colocate" its surface transportation field structure. Over 2 years have passed, and DOT has done little to take advantage of these opportunities.

Other Major Issues

- Other major issues that DOT and the Congress must address include the long-term financing of FAA, the continuing financial problems of Amtrak, and the Coast Guard's ability to measure its effectiveness in drug interdiction. FAA could face potential funding shortfalls totaling several billion dollars over the next 5 years. However, this shortfall could be mitigated to some extent if FAA improves its productivity. The Congress has recognized the funding problems confronting FAA, which are exacerbated by the need to finance safety and security improvements and air traffic control modernization. The congressionally created National Civil Aviation Review Commission is tasked with reporting to the

Secretary of Transportation later this year on how best to finance FAA.

- Our recent work on Amtrak shows that the corporation is still in a very precarious financial position and remains heavily dependent on federal support to meet its operating and capital needs. Amtrak's fiscal year 1997 operating losses could be as high as \$786 million. While the corporation's goal is to eliminate the need for federal operating support by 2002, it is likely that Amtrak will continue to require federal financial support—both operating and capital—beyond that time.
- In its fiscal year 1998 budget request, the Administration is asking for \$389 million related to the Coast Guard's drug interdiction efforts, a \$53 million increase over 1997 levels. Identifying ways to measure the effectiveness of the Coast Guard's operations in this area is inherently difficult. To measure its effectiveness, the Coast Guard must separate the impact of its actions from those taken by other drug enforcement agencies. In order to accomplish this, the Coast Guard must develop a way to compare the amount of drugs seized or deterred against a measure of supply, which becomes problematic. The Coast Guard has started to take actions to address these difficulties and implement the requirements of the Government Performance and Results Act, but it is too soon to determine their effectiveness.

We will now discuss these issues in greater detail.

Safety and Security Issues

Improving the safety and security of our aviation and surface transportation systems is of paramount importance, but budget constraints will make this a tremendous challenge.

Aviation Safety and Security

Over the years, we have issued numerous reports and testimonies that identified shortcomings in FAA's aviation safety and security programs.² These shortcomings include insufficient training of FAA safety inspectors, inaccurate and incomplete aviation safety databases, and vulnerabilities in our aviation security systems. We have reported that targeting inspection

²See, for example, *Aviation Safety: New Airlines Illustrate Long-Standing Problems in FAA's Inspection Program* (GAO/RCED-97-2, Oct. 17, 1996); *Aviation Safety: Data Problems Threaten FAA Strides on Safety Analysis System* (GAO/AIMD-95-27, Feb. 8, 1995); *Aviation Security: Additional Actions Needed to Meet Domestic and International Challenges* (GAO/RCED-94-38, Jan. 27, 1994); and *Aviation Security: Technology's Role in Addressing Vulnerabilities* (GAO/T-RCED/NSIAD-96-262, Sept. 19, 1996).

resources is important because of the magnitude of FAA's inspection responsibilities. For example, as early as 1987, we identified the need for FAA to develop criteria for targeting safety inspections to those areas that have characteristics possibly indicating safety problems—especially new entrant and commuter airlines and aging aircraft. FAA also needs to improve its Safety Performance Analysis System, a system being developed to integrate and analyze information within other databases, so that it contains reliable information that can be used by inspectors and managers to target the areas of greatest risk to safety.

In the area of aviation security, we have highlighted a number of vulnerabilities that exist within the nation's air transportation system for checked and carry-on baggage, mail, and cargo. We have also raised concerns about unauthorized individuals' gaining access to critical parts of an airport and the potential use of sophisticated weapons, such as surface-to-air missiles, against commercial aircraft. We have stressed the need for a mix of technology and procedures to improve security. FAA has agreed with the majority of our recommendations and is taking action on many of them.

As a result of the May 1996 crash of ValuJet Flight 592, in which 110 people were killed, the FAA Administrator, on June 18, 1996, commissioned a 90-day study of the agency's safety programs. On September 16, 1996, FAA issued its report, which contained six broad and 31 specific recommendations.³ The report calls for improvements in a number of areas, including the certification of new airlines and FAA's inspection activities. FAA developed a plan for implementing these recommendations, including identifying the responsible person and key milestones for these efforts. According to FAA, over one-third of the key milestones have been met. The remaining recommendations are to be implemented between now and 1999.

Moreover, on July 25, 1996, in the wake of the crash of TWA Flight 800, in which another 230 people perished, the President formed the White House Commission on Aviation Safety and Security (the Gore Commission) to study and develop a strategy for improving aviation safety and security, including the ATC modernization. Its February 12, 1997, final report to the President contained over 50 recommendations on a wide variety of aviation issues, including improving aviation safety, modernizing the ATC system, ensuring security for travelers, and compassionately responding to

³FAA 90 Day Safety Review (Sept. 16, 1996).

families who have been affected by aviation disasters.⁴ In addition, the Congress has eliminated FAA's role of promoting the aviation industry and clarified that FAA's highest priority is safety. Furthermore, the administration requested and the Congress appropriated supplemental 1997 funds to improve aviation security by installing explosives detection equipment and assigning bomb-sniffing dog teams to a number of major airports. In its fiscal year 1998 budget proposal, the administration is requesting additional funds to further improve safety and security, including hiring more inspectors and providing them with additional training.

For air safety, the Commission set a goal of cutting the airline accident rate by 80 percent over the next 10 years. To help achieve this goal, the President announced that the National Aeronautics and Space Administration (NASA) will dedicate up to a half billion dollars in its research and development budget over the next 5 years to focus on aviation safety. One of the Commission's key recommendations is that cost considerations alone should not be the only, nor the primary, factor in making policy and rulemaking decisions concerning aviation safety and security. It is important to recognize, however, that this change could result in significant cost increases for relatively modest increases in the safety margin.

Overall, we believe that the Commission's recommendations are a good start toward an evolutionary process of reaching agreement on the goals and objectives for improving our aviation safety and security systems. However, the Commission's final report does not fully address what the cost will be or who should pay for implementing the recommendations. For example, in the security area, the Commission recommended that the federal government devote \$100 million annually to meet security capital requirements—leaving the issue of how to fund the remaining security costs to the National Civil Aviation Review Commission. These remaining costs are estimated to be in the billions of dollars.

To help ensure implementation of its recommendations, the Commission recommended that the Secretary of Transportation report annually on their status and that the President hold DOT and FAA leaders accountable for implementing them. The same rigors should be applied to ensure the implementation of other recommendations, such as those contained in FAA's 90-day safety review. Reporting annually on the progress of

⁴Final Report to President Clinton, White House Commission on Aviation Safety and Security (Feb. 12, 1997).

implementing all safety and security recommendations will allow for comprehensive congressional oversight as well as a mechanism for determining funding trade-offs and prioritization. Keys to the successful implementation of these recommendations are stable leadership at the Department and FAA and adequate funding. We have expressed concern over the years about the instability and uncertainty caused by the frequent turnover of FAA Administrators. In addition, if FAA's funding issue is not resolved, resources may not be available to implement improvements recommended by the various studies.

On the basis of recommendations made in an initial report by the Gore Commission (dated Sept. 1996), the Congress appropriated \$144.2 million for FAA to purchase and install advanced explosives detection equipment at U.S. airports and an additional \$21 million for explosives detection research. At your request, we are examining the status of FAA's actions. To date, we have found that FAA has started purchasing the equipment that the Secretary has directed be acquired and deployed by December 1997. To expedite the process, FAA has been awarding most contracts for equipment and related services on a noncompetitive basis and plans to ask for a waiver from preparing a number of planning documents required under the agency's procurement system. In conjunction with airlines and airports, FAA has also drafted a plan specifying which airlines and airports are to receive the equipment.

Surface Transportation Safety

The use of seat belts, the safety of large trucks in general and, more specifically, Mexican trucks coming into the United States; and railroad safety are all important surface transportation safety issues. We have completed or have under way a number of studies concerning these issues.

Reducing Fatalities and Injuries Caused by Highway Traffic Accidents

Traffic accidents annually result in over 40,000 deaths and over \$130 billion in costs to society. Each year, about 20,000 of the people who die and another 600,000 people who are injured were not using safety belts. As we reported in January 1996, increasing the use of safety belts is the most effective way to lower the nation's death toll from highway accidents.⁵ NHTSA estimates that 10,000 deaths, 200,000 injuries, and \$20 billion in societal costs could be avoided annually if all occupants of motor vehicles wore safety belts. To date, every state except New Hampshire has enacted laws requiring the use of safety belts; however, the

⁵Motor Vehicle Safety: Comprehensive State Programs Offer Best Opportunity for Increasing Use of Safety Belts (GAO/RCED-96-24, Jan. 3, 1996).

coverage of these laws may not include all vehicle occupants and may be limited to certain types of vehicles.

According to NHTSA, in 1996 the use of safety belts among states ranged from a low of 43 percent to a high of 87 percent. The most successful states in increasing safety belt use generally have comprehensive programs that include primary enforcement laws, visible and aggressive enforcement, and active public information and education programs. In particular, 11 states have primary enforcement laws which permit officials to enforce safety belt requirements independent of other traffic safety laws. In contrast, under secondary enforcement laws enforcement of safety belt requirements can only occur when other traffic safety laws are also being enforced. Of the 10 states we reviewed for our 1996 report, the 3 states with primary enforcement laws averaged rates of belt use about 20 percent higher than the states with secondary enforcement laws.

Much attention in recent months has been focused on the potential danger surrounding the deployment of a car's air bags onto small adult drivers and children riding in the front seat. While air bags have saved more than 1,700 lives, NHTSA has attributed 61 deaths in low-speed crashes to air bags. In response to this hazard, NHTSA initiated a public information campaign aimed at having infants and children ride in the rear. NHTSA has also undertaken a series of regulatory initiatives to address the adverse side effects of airbags. Among other things, NHTSA has issued a final rule regarding improved labeling on new vehicles and child restraints, and a proposed rule designed to ensure that vehicle manufacturers can reduce the power at which airbags inflate. In addition, NHTSA is conducting research into developing "smart" air bags that would use sensors to automatically adjust the deployment speed to the size of the occupant. In recent congressional hearings on how NHTSA can best reduce the danger of air bags for children and small adults, safety experts emphasized that the most effective way to reduce deaths and serious injuries from traffic accidents is to increase the use of safety belts by drivers and passengers.

Need to Improve Large Truck Safety

Large trucks are vital for our nation's commerce, yet thousands of people die each year in accidents involving trucks. Although the rate of fatal accidents involving large trucks has decreased substantially from 4.3 fatal accidents per 100 million miles in 1982 to 2.5 fatal accidents per 100 million miles in 1995, this change primarily reflects the increase in the miles that trucks are driving. In reality, the number of accidents and fatalities only slightly declined from 4,650 fatal accidents involving trucks with 5,230 deaths in 1982 to 4,450 such accidents with 4,900 deaths in 1995.

State and industry officials have told us that much of the improvement in truck safety can be attributed to FHWA's Motor Carrier Safety Assistance Program (MCSAP), which provides matching grants for states to conduct (1) roadside inspections of trucks and their drivers, (2) compliance reviews of trucking firms' operations, and (3) other truck safety enforcement programs. MCSAP also helps states collect and report truck accident and enforcement data to FHWA's SafetyNet database, which is essential for using performance-based standards to assess a trucking firm's safety.⁶ In MCSAP's early years, FHWA used funding to shift responsibility for roadside inspections of trucks to the states. As a result, the number of roadside inspections increased from 33,000 in 1982 to almost 2 million in 1996.

We are currently examining FHWA's truck safety program to identify cost-effective ways to further reduce fatal accidents involving trucks. Our preliminary findings show that FHWA has the primary responsibility for conducting compliance reviews, although states performed about 40 percent of the compliance reviews in 1996. While several states have developed active compliance review programs, other states are only beginning to perform compliance reviews, and 13 states do not perform any. Opportunities may exist to use MCSAP funding to encourage states to assume a larger role in performing compliance reviews, as was the case for roadside inspections.

To improve its targeting of trucking firms for roadside inspections and compliance reviews, FHWA is beginning to implement performance-based standards. Truck accident and inspection data that states provide to the SafetyNet database are essential for assessing a carrier's performance. States have improved both the quality and timeliness of their reporting. For example, they increased the percentage of truck accidents reported to SafetyNet from 14 percent in fiscal year 1992 to about 60 percent in fiscal year 1995. Opportunities may exist to share information among states that would enable some states to overcome institutional or procedural barriers and further improve their reporting.

Safety of Mexican Trucks

Currently, trucks from Mexico enter the U.S. through 4 border states (i.e., Texas, New Mexico, Arizona, and California) and are limited to operating in designated areas in the U.S. called commercial zones (generally, areas between 3 and 20 miles from U.S. border towns' northern limits). However, the North American Free Trade Agreement (NAFTA) calls for

⁶SafetyNet is an electronic database that incorporates truck accident, roadside inspection, and other enforcement data that is used by FHWA and the states to better identify trucking firms with safety problems for compliance reviews and other enforcement actions.

allowing U.S. and Mexican trucks to eventually operate throughout both countries. In February 1996, we reported that many trucks from Mexico, operating in the U.S. commercial zones, were not meeting U.S. safety standards and that the four U.S. border states' readiness for enforcement varied significantly.⁷ With nearly 12,000 trucks from Mexico crossing daily into the border states, we need to be assured that these trucks are safe. NAFTA's timetable for international access called for U.S. and Mexican trucks to be able to operate in each country's border states as of December 18, 1995. But, on that date, the U.S. Secretary of Transportation delayed this from happening, because of safety and security concerns regarding Mexican trucks. The delay is still in effect. The next milestone in NAFTA is the provision allowing full access in both countries starting on January 1, 2000.

We are conducting a follow-on review of the status of inspection and enforcement activities of Mexican trucks in 3 of the border states.⁸ While we have not completed our work, we would like to share our preliminary findings with you. State and federal truck inspectors at the border told us that trucks have become safer, based on data such as fewer safety violations being given per truck. However these views are anecdotal. After more than 1 year of intensified truck inspections, it remains unclear as to whether trucks from Mexico are becoming safer. From January through November 1996, federal and state officials carried out more than 20,000 inspections of trucks entering from Mexico, resulting in about 45 percent of the vehicles being placed out of service for serious safety violations. The data show no consistent trend, downward or otherwise. Moreover, 45 percent compares unfavorably to the 28 percent out-of-service rate for U.S. trucks inspected across the United States. On the other hand, state and federal truck inspectors we interviewed believe that Mexican operators are upgrading their trucks to make them safer. Also, according to industry experts, most Mexican trucks at the border are involved in short-haul operations only and they believe that newer and presumably safer trucks will be used for long-haul operations further into the United States.

The three border states have more than doubled the number of truck inspectors at the major border crossings and now have 83 inspectors, compared to 39 a year ago. Also, DOT has approved the placement of 13

⁷Commercial Trucking: Safety and Infrastructure Issues Under the North American Free Trade Agreement (GAO/RCED-96-61, Feb. 29, 1996).

⁸Because Mexican trucks entering the border state of New Mexico comprised about one percent of all northbound truck crossings, we did not include New Mexico in our review.

federal safety inspectors on the border for a two-year period. California, with about 24 percent of the overall Mexican truck traffic, has opened two large permanent inspection facilities, where it tries to inspect every truck entering from Mexico at least once every 3 months. However, neither Texas nor Arizona, which admit about three-quarters of the overall Mexican truck traffic, has built any permanent inspection facilities at border locations. State officials told us that a lack of space at urban border crossings and their view of NAFTA as a national issue that should be paid for with federal funds are among the reasons they have not built any inspection facilities.

DOT has a number of initiatives under way aimed at ensuring the safety of Mexican trucks crossing the border. They include providing some additional funds to border states for more truck inspections, running educational campaigns on U.S. safety standards, and training truck inspectors in Mexico. Enforcing safety standards for unsafe Mexican trucks is hampered, however, because DOT's strategy does not include helping border states develop results-oriented truck inspection strategies. DOT has also not actively worked with other federal and state agencies, such as the U.S. Customs Service, to build truck inspection facilities on the border.

Rail Safety

In the area of rail safety, we are currently examining whether new initiatives within the Federal Railroad Administration (FRA) will improve safety on the nation's rail lines. From 1976 through 1995, the rail industry's accident rate per million train miles declined by 70 percent. Similarly, the industry's injury rate per million train miles declined by about 74 percent during the same period. Although these improvements are commendable, a continued focus on safety is needed, since improvements in the accident rate have slowed substantially since 1987, and over 1,000 people are still killed annually at grade crossings or while trespassing on railroad property. We are reviewing these trends in detail and assessing FRA's initiatives to improving safety on the nation's rail lines. Under these initiatives, FRA works with other federal agencies, railroad management, labor, and the states to implement methods that will reduce grade-crossing accidents, expedite the promulgation of important safety regulations, and secure railroads' compliance with existing safety rules.

Management Issues

Our work has shown that DOT needs to improve its management of aviation, highway, and transit programs to ensure that limited funds are effectively and efficiently used. We have identified some underlying causes

for the numerous cost, schedule, and performance problems experienced by FAA's ATC modernization program. In addition, major surface transportation projects, costing hundreds of millions to billions of dollars each, are continuing to incur cost increases, experience delays, and have difficulties acquiring needed funding commitments. Consequently, the federal, state, and local stakeholders could be asked to pay for more of these costs or the projects' completion could be jeopardized.

Air Traffic Control Modernization Problems

FAA is in the midst of a multibillion dollar, mission-critical capital investment program to modernize its aging ATC system. Begun in 1981, this effort involves the acquisition of a vast network of radars and automated data processing, navigation, and communications equipment. FAA estimates that the cost of modernizing the system will total \$34 billion through 2003, of which \$21 billion represents software-intensive computer systems. The Congress has already appropriated about \$23 billion of the \$34 billion investment.

Over the years, we have reported that ATC modernization projects have experienced substantial cost overruns, lengthy delays, and significant shortfalls in performance that have affected FAA's ability to deliver systems as promised. We have identified numerous causes for these problems, including technical difficulties, management problems, and the lack of continuity in FAA's top management. Because of the size, complexity, cost, and problem-plagued past of the ATC modernization, we designated it as a high-risk information technology initiative in 1995 and again in 1997.⁹

The framework for effectively addressing the modernization's problems is grounded in management practices followed by leading public sector and private sector organizations and embodied in the Clinger-Cohen Act of 1996 (P.L. 104-106). Among its provisions, the act emphasizes the involvement of senior executives in decisions about information management, the development and implementation of systems architectures, and the institution of discipline in such areas as investment management and system development and acquisition. FAA views its new Acquisition Management System, established last year, as a rational approach to acquisitions.

In addition, because ATC modernization is critical to aviation safety and offers cost savings to users of the national airspace and FAA, the Gore

⁹High-Risk Series: An Overview (GAO/HR-95-1, Feb. 1995); and High-Risk Series: Information Management and Technology (GAO/HR-97-9, Feb. 1997).

Commission recommended that FAA accelerate its program by 7 years or more so that the new ATC architecture is operational by 2005. However, we have some concerns about how realistic that goal may be.

ATC Modernization Lacks a Complete Systems Architecture

FAA's ATC modernization program consists of hundreds of interrelated, interdependent systems that need to be defined as part of a complete systems architecture. Simply stated, a systems architecture is a blueprint to guide and constrain the development and evolution (i.e., maintenance) of a collection of related systems. It consists of two principal components—a "logical" architecture and a "technical" architecture. The logical architecture includes a high-level description of the organization's mission, functional requirements, information requirements, systems, information flows, and interfaces. It is the means for ensuring that systems support business needs. The technical architecture details the specific information technology and communications standards and approaches that will be used to build systems' hardware, software, communications, data management, and security elements. It ensures that systems interoperate effectively and efficiently.

FAA has been effective thus far in developing the logical component of a systems architecture, commonly called the National Airspace System architecture. However, FAA is missing the technical component, and we do not see a coordinated effort under way to produce one for the entire modernization program. Of course, just having a complete systems architecture is not enough. To be effective, the architecture must also be enforced consistently, meaning that systems must comply with the architecture and that any architectural deviations must be justified. At FAA, such architectural enforcement is not occurring.

FAA's failure to define and enforce a complete ATC systems architecture has permitted incompatibilities among existing systems and will continue to do so for future systems. While this does not mean that ATC systems cannot work together safely, it does mean that working together costs more (for development and maintenance) than it should and that overall efficiency is less than optimal. To fill these voids, our February 1997 report recommends that FAA establish an effective management structure for developing and enforcing a complete systems architecture.¹⁰

ATC Modernization Lacks Reliable Cost Information

Effectively managing an investment portfolio requires reliable cost information on each investment. Without reliable cost information, the

¹⁰Air Traffic Control: Complete and Enforced Architecture Needed for FAA Systems Modernization (GAO/AIMD-97-30, Feb. 3, 1997).

likelihood of poor investment decisions is increased appreciably not only when a project is initiated but also throughout its life cycle. Such a situation is unacceptable when making small investments, but it is especially egregious when making multimillion- or billion-dollar investments in mission-critical ATC systems.

We have no confidence that FAA's ATC projects' actual or estimated costs are accurate. Our concerns with estimated costs are grounded in FAA's weak processes for deriving these estimates. In fact, of the six processes (e.g., data collection and feedback on actual performance) that experts say should be institutionalized by organizations that build or acquire software-intensive systems, FAA only partially satisfies one and is completely lacking in the other five. The result is cost estimates that are not analytically derived and supported. Compounding these weaknesses is FAA's practice of presenting estimates as precise, point estimates, rather than presenting a cost range that explicitly describes the inherent uncertainty and risk involved. Our concerns also extend to the accumulation and reporting of ATC projects' actual costs, and to FAA's lack of a cost accounting capability. In lieu of one, FAA relies on an assortment of accounting and financial management systems, but these systems do not capture all relevant costs, such as those associated with FAA's internal project management. Our January 1997 report recommends that FAA take actions to correct these problems.¹¹ As required by the Federal Aviation Reauthorization Act of 1996, FAA is planning to implement a cost accounting system.

ATC Modernization's Software Acquisition Capability Is Immature

Software is the most expensive and complex component of today's computer systems. It is also the component that is the source of most system development problems. The quality of software is determined largely by the quality of the processes involved in developing or acquiring, and maintaining it. Carnegie Mellon University's Software Engineering Institute (SEI), recognized for its expertise in software processes, has developed models and methods that define and determine the maturity of an organization's software processes. Together, they provide a logical framework for determining a baseline of an organization's strengths and weaknesses and providing a structured plan for incremental improvement.

We are currently evaluating FAA's software acquisition processes and the steps under way or planned to improve them. Our preliminary results show some strengths but more weaknesses. In fact, FAA does not fully

¹¹Air Traffic Control: Improved Cost Information Needed to Make Billion-Dollar Modernization Investment Decisions (GAO/AIMD-97-20, Jan. 22, 1997).

satisfy any of the key areas necessary to achieve a repeatable level of maturity in its processes, rendering them ad hoc, and sometimes chaotic. On SEI's process maturity scale of 1 through 5, FAA is at the lowest level and is at great risk of not delivering software on time and within budget that performs as intended. Additionally, FAA lacks an effective management approach for improving its software acquisition processes. In particular, it has not assigned the responsibility for improvement to an organizational entity that has budgetary or organizational authority over the product teams that are acquiring software, and it does not yet have an effective plan to properly focus and coordinate improvement initiatives and measure progress. As a result, years of activity in this area have yielded little in the way of improvements to processes. We plan to make recommendations in these areas.

FAA's Organizational Culture Hinders Acquisition

In August 1996, we reported to this Subcommittee that an underlying cause of FAA's ATC acquisition problems is its organizational culture—the beliefs, values, and attitudes shared by an organization's members, which affect their behavior and the behavior of the organization as a whole.¹² We found that FAA's acquisitions were impaired when employees acted in ways that did not reflect a strong commitment to mission focus, accountability, coordination, and adaptability. For example, we reported that installations of new terminal Doppler weather and airport surveillance radars were delayed when the project offices did not coordinate with field offices to ensure that sites suitable for installing these systems had been acquired. We recommended that FAA develop a comprehensive strategy for cultural change that (1) addresses specific responsibilities and performance measures for all stakeholders throughout FAA and (2) provides the incentives needed to promote the desired behaviors and achieve agencywide cultural change.

In line with our recommendation, FAA established the Office of Business Management within the Office of the Associate Administrator for Research and Acquisitions to broadly define the proper framework for cultural reform. This office plans to develop a strategic vision and business goals for FAA's acquisition efforts, create a planning process, manage goal attainment, and develop performance measures to gauge progress in implementing change. Also, FAA's Research and Acquisitions unit is monitoring its progress in effecting cultural change through staff surveys. The challenge facing FAA in changing its culture is finding ways to broaden its efforts to include stakeholders from across the agency.

¹²Aviation Acquisition: A Comprehensive Strategy Is Needed for Cultural Change at FAA (GAO/RCED-96-159, Aug. 22, 1996).

Observations on Gore
Commission's Proposals for
Accelerating ATC
Modernization

The Gore Commission found that "it is critical to our global leadership in civil aviation to finance an accelerated modernization" of the ATC system. New technology such as satellite-based navigation offers significant cost savings for users of the ATC system and for FAA. The Gore Commission recommended that all elements of the agency's planned ATC architecture should be fully operational by 2005 rather than 2012 and beyond, which is FAA's current timetable.

While it would provide tremendous benefits to move up the completion of the modernization effort by 7 years, we have some concerns about FAA's ability to achieve that goal. First, the challenges encountered in acquiring new ATC technology have to be recognized. Although the Gore Commission states that new ATC technology to meet FAA's requirements is available "off the shelf," FAA has found that significant development efforts have been needed for virtually all major acquisitions over the past decade. As recently as this past year, for example, new major contracts for two key components of the modernization effort—the Standard Terminal Automation Replacement System (STARS) and the Wide Area Augmentation System (WAAS)¹³—called for considerable development efforts that are not scheduled for completion until after the year 2000. As noted in many of our reports, FAA has frequently found it difficult to meet the technical and managerial challenges associated with developing and fielding modern ATC equipment. (Further information on the status of these and other ATC acquisitions that are central to FAA's modernization effort is provided in appendixes I, II and III.)

Second, modernizing the system at an accelerated rate could prove to be inconsistent with the principles of its new acquisition management system, established on April 1, 1996, in response to legislation freeing the agency from most federal procurement laws and regulations.¹⁴ The system calls for the agency to go through a disciplined process of defining its mission needs, analyzing alternative technological and operational approaches to meeting those needs, and selecting only the most cost-effective solutions. Until FAA goes through that analytical and decisionmaking process, it is premature to predict what new technology should be acquired. In developing the ATC architecture, FAA made certain assumptions about its future needs for technology upgrades and additional capabilities. However, when looking 5 or more years into the future, it is difficult for

¹³The wide area system will use commercial communications satellites to augment GPS' signals in the airspace between and around airports to aid civil aircraft in navigating air routes and landing.

¹⁴P.L. 104-50, section 348.

FAA to predict mission needs and the likely advances in technology with any degree of certainty.

As discussed later in this testimony, there are also significant funding implications associated with accelerating the modernization program.

Surface Transportation Programs

Let me turn for a moment to DOT's management of major surface transportation programs. Our work has focused on the need for management attention in three areas: (1) cost control and committed financing to cover all potential costs for large-dollar surface transportation projects; (2) federal leadership that provides incentives to assist states and localities to overcome barriers to deploying the Intelligent Transportation System (ITS); and (3) an organizational structure that balances improving programs' delivery of services with ensuring the least cost to the taxpayer.

Cost Control of Large-Dollar Highway Projects Could Improve

The nation's highways and bridges are vital to our economy and national defense. It is essential that highway and bridge projects be well managed because of limited resources available to build and maintain them. Because large-dollar projects generally take longer to build and usually have more significant environmental and community impacts than the majority of federal-aid highway projects, they have a greater potential to experience substantial cost increases and lengthy construction delays. These cost increases can potentially overwhelm other highway projects and erode the already limited funds available to meet highway needs overall. Effective project management to contain costs can help ensure that cost growth resulting from delays and other factors is minimized and that transportation investment dollars are spent wisely and efficiently.

As discussed in our recently issued report on managing the costs of large-dollar highway projects, cost containment is not an explicit statutory or regulatory goal of FHWA's oversight.¹⁵ As such, FHWA has done little to ensure cost containment is an integral part of the states' project management. FHWA influences the cost-effectiveness of projects by its review and approval of design and construction plans and through daily interaction with state departments of transportation. FHWA's project approval process consists of a series of incremental actions that occur over the period of years required to plan, design, and build a project. FHWA approves the estimated cost of a large-dollar project in segments, when those project segments are ready for construction, rather than agreeing to

¹⁵Transportation Infrastructure: Managing the Costs of Large-Dollar Highway Projects (GAO/RCED-97-47, Feb. 28, 1997).

the total cost of the project from the outset. So, by the time FHWA approves the cost of a large-dollar project, a public investment decision may have effectively been made because substantial funds will have already been spent on designing the project and acquiring property, and much of any increase in the project's estimated costs will have already occurred.

While many factors can cause costs to increase, we found several that worked together to increase costs beyond the initial estimates for projects in the six states we describe in our February 1997 report: (1) initial estimates are preliminary and not designed to be reliable predictors of a project's cost, (2) initial estimates are modified to reflect more detailed plans and specifications as a project is designed, and (3) a project's costs are affected by, among other things, inflation and changes in scope to accommodate economic development that occurs over time as a project is designed and built. Finding that some states were using good cost management practices, we recommended that FHWA be proactive in evaluating and disseminating states' best practices so that all states could benefit from their use.

Cost and Financing Concerns Remain for the Central Artery/Tunnel Project

The Central Artery/Tunnel project, in Boston, Massachusetts, estimated to cost \$10.4 billion, is one of the largest and most expensive highway construction projects ever undertaken. It has advanced further in the last year than at any other time in its history. With the Ted Williams Tunnel open to traffic and construction of the underground Central Artery well under way, the project is about 85 percent designed and 25 percent constructed. About \$8 billion of the \$10.4 billion in contracts are either complete or awarded. The project's most recent finance plan was issued in September 1996. This plan was followed in December 1996 with a report by consultants on the feasibility of various options for financing the state's share of completing and operating the project.

Massachusetts reports that the project's costs have stabilized, the risk of further cost increases is minimal, and financing options are available to meet funding shortfalls. The state has made progress in the past year by putting strategies in place designed to meet the aggressive cost containment goals for the design and construction phases of the project and by moving forward with legislation to implement the recommendations of the state's Secretary of Transportation based on the financing strategies in the consultants' feasibility study. However, on the basis of our ongoing work, we remain concerned that (1) the project's costs have increased and assumptions about cost savings to offset those increases and keep the overall cost estimate at \$10.4 billion may be

optimistic, and (2) while Massachusetts has begun taking action on the recommended financing strategies, it may not be enough to meet funding shortfalls.

The project's \$10.4 billion cost estimate depends on a number of assumptions, including meeting the cost containment goals established for the project as well as the reasonableness of potential savings used to offset cost increases. The project established an aggressive overall goal in 1995 that construction contract changes would not exceed 10.7 percent of the estimated value of the contracts. However, our analysis shows that the project has not met that goal for awarded contracts, as the forecast changes for these contracts averaged 16 to 19 percent as of November 30, 1996. With 64 construction contracts awarded and 49 construction contracts still unawarded, it may be difficult to keep changes down sufficiently to meet the 10.7 percent goal. The September 1996 finance plan describes other cost increases since the February 1996 finance plan, including \$80 million related to projectwide support and \$25 million for additional right-of-way costs. However, the finance plan also shows cost savings to offset identified cost increases, such as a \$15 million reduction in one of the project's tunnel designs, to maintain the project cost at \$10.4 billion.

The largest overall savings—\$600 million—comes from the project's Owner-Controlled Insurance Program consisting of six separate insurance policies, including workers' compensation and general liability. Since December 1994, the estimated cost of the insurance program has decreased from \$748 million to \$148 million. These savings assume a scenario below what is usually used by the industry, justified, according to project officials, on the project's low claims and accident rates for the last three years. However, the project is beginning 6 years of underground tunneling in the congested downtown area that will entail numerous and intricate construction challenges. For example, the project will burrow close to buildings and subway tunnels often with only a few feet to spare. While the project cites an excellent safety record to date, with these inherent construction risks, the insurance savings may not be realized.

Our analysis of the state's feasibility study identifies two shortfalls between the project's obligation requirements and the funding sources identified to date: (1) an interim funding gap of \$1.7 billion to \$2.3 billion during the fiscal year 1998 through 2002 period and (2) a total funding gap of \$100 million to \$700 million between fiscal years 1998 and 2005. These two gaps differ because, according to the study, the project's costs will

outweigh identified sources of funding each year between fiscal years 1998 and 2002; conversely, financing will exceed costs in each of the last 3 years of the project from fiscal year 2003 through 2005, resulting in a \$1.6 billion surplus during that period. The study proposes a strategy of state borrowing to cover both funding shortfalls, including (1) a contribution from the Massachusetts Turnpike Authority, based on revenue bonds backed by toll increases, which the state has recommended total \$1 billion—\$700 million in the short term and \$300 million upon completion of the Central Artery portion of the project, and (2) issuance of short-term “grant anticipation notes”, to be repaid with future federal highway apportionments. We have concerns that these financing strategies may not be sufficient to meet the shortfalls. For example:

- There may be an additional demand on the Massachusetts Turnpike Authority. The project has already counted on funding from a \$400 million state contribution authorized in 1995, which the state’s 5-year capital plan identifies as a contribution from the Authority. The Authority has not yet made this contribution and it would be in addition to the recommended \$1 billion contribution.
- While the financial markets will ultimately decide whether using grant anticipation notes to leverage future federal funds is feasible, a number of challenges need to be overcome. There is limited precedent for borrowing funds in this manner, particularly in the amount—\$1 billion or more—suggested by the state. Furthermore, since the feasibility study assumes only \$675 million in federal funds dedicated to the project during the surplus fiscal years from 2003 through 2005, the state may have to use federal funds to pay off the grant anticipation notes beyond the project’s scheduled completion in fiscal year 2005, and beyond the likely duration of the next highway authorization bill.
- The \$1.6 billion “surplus” between fiscal years 2003 and 2005 may be smaller than reported. Nearly \$1 billion of this surplus is savings from the insurance program and “air rights” revenues—proceeds the state expects to receive from the development of property acquired for the project. The project has reflected \$722 million in insurance proceeds as a credit to the cost of the project in fiscal year 2005. However, even if its assumptions about the cost of the insurance program are realized, the project does not expect to receive these proceeds until the insurance program ends in 2018, and the amount of the proceeds is based on accruing interest through that time. The state will realize proceeds from development of air rights and, by federal law, can use those proceeds for transportation-related purposes.

However, around half the property expected to be available will not be ready for development until late 2004. As such, Massachusetts may not realize much of the financial benefits from the sale of air rights until after 2005.

Funding shortfalls will grow if the costs of the project increase or if federal funds under the next authorization are less than expected. If shortfalls grow, or if surpluses are not available as expected, the state will likely have to incur additional debt over a longer period of time to meet the project's financing needs. This may require Massachusetts to devote a substantial portion of its federal and state transportation funds to the Central Artery/Tunnel project for several years after the facility is completed and carrying traffic.

BART: Critical Decisions Still on Hold

The Bay Area Rapid Transit District (BART) intends to spend over \$1.1 billion, including \$750 million in federal funds, to extend mass transit service to the San Francisco International Airport. Since last year, we and the Congress have voiced several concerns about the financing of the project. As we reported in August 1996, BART has taken a number of steps that have improved the project's financing, including (1) escalating certain costs to better account for inflation; (2) improving its borrowing program by identifying secondary sources of collateral and gaining a needed change in state law; and (3) identifying additional funds should they become necessary to finance the project, including joint development revenues, advertising, concessions, and parking fees.¹⁶ In November 1996, the Federal Transit Administration (FTA) informed both the House and Senate Appropriations Subcommittees that it was satisfied with the project's financing and that a full-funding grant agreement could be awarded. The grant agreement will establish a ceiling for the federal government's commitment, subject to the annual appropriations process.

While BART has improved the project's financing overall, its November 1996 finance plan still includes optimistic assumptions about the annual level of federal funding to be received under FTA's New Starts Program. The November plan specifies federal funding of \$110 million in fiscal year 2000, \$160 million in fiscal year 2001, \$150 million in fiscal year 2002, and \$108 million in fiscal year 2003. These compare to annual funding levels of between \$110 million to \$120 million that BART had included in previous finance plans and that FTA had criticized as optimistic. BART's request for funding of \$160 million in fiscal year 2001 would, for example, represent 20 percent of the \$760 million in FTA's current annual budget for the New

¹⁶BART Airport Extension Update (GAO/RCED-96-246R, Aug. 30, 1996).

Starts Program. A slower rate of annual federal funding than assumed would have the effect of increasing BART's financing costs, which BART currently estimates to be \$40 million.

In addition, your subcommittee expressed other concerns about the project's financing in your January 7, 1997, letter to FTA and FAA. Among your key concerns were whether (1) BART's use of a surcharge at the airport station constituted an improper diversion of airport funds and (2) BART is required to pay the airport rent for using a station built with airport revenues. On February 11, 1997, the agencies responded to you. The response states that DOT will ensure that any implemented surcharge will comply with applicable laws but does not definitively conclude whether the proposed airport station surcharge constitutes revenue diversion. Because this surcharge is part of the project's overall finance plan, it is important that DOT make a decision on whether it is a revenue diversion. Concerning the second issue, FAA has not yet determined the appropriateness of the airport's plan for BART's free use of airport property. FAA has issued for comment a proposed policy statement addressing, among other things, whether airports may charge transit agencies less than commercial rates for the use of airport property for public transit facilities. In the proposed policy statement, FAA takes the view that airports may charge publicly owned transit systems below market rates for the use of airport property for facilities necessary for the transportation of passengers, visitors, and employees to and from the airport, given the significant benefits that can be achieved through such public transit. FAA also specifically requested comments on whether some compensation from the use of airport property should be required. The comment period for this policy statement closed on February 18, 1997.

DOT's response concluded that the project is at a critical juncture and that BART's construction needs to proceed in parallel with the airport's ongoing construction of its light rail system because the two systems will share the same structure. The airport's light rail system is designed to move passengers throughout the airport. According to the airport's Director of Finance, the airport plans to award the initial construction contracts for the BART station in March 1997 and all such contracts by the end of June 1997. He said that without a full-funding grant agreement, there is no guarantee that BART will come into the airport. If it does not, he stated, the airport will have to decide whether to incorporate BART into the light rail system or build a less expensive structure for light rail only. He noted that building a structure solely for light rail could have the effect of designing

Los Angeles Red Line's Costs and Schedule Still Increasing

BART out of the airport altogether. The airport has not yet made a decision on how to proceed if there is no full-funding grant agreement.

The Los Angeles Red Line Project, a 23.4-mile heavy rail subway system, is facing cost increases as well as financing uncertainties associated with funding shortfalls and the long-term financial capacity of the Los Angeles County Metropolitan Transit Authority (MTA), the project manager. The project currently consists of three segments, two of which are complete or near completion. The third segment involves the design and construction of three extensions to North Hollywood, East Side, and Mid City.

According to January 1997 estimates by MTA, the Red Line project will cost \$6.1 billion, or about 12 percent (\$651 million) above the \$5.5 billion estimated in grant agreements. The \$6.1 billion includes \$192 million to reconfigure a portion of the tunnel planned for the Mid City extension needed to avoid concentrations of hydrogen sulfide gas in the tunnel. Because the \$192 million estimate represents one of three options being considered to address the problem, costs could increase on the basis of MTA's final decision, due in August 1997.¹⁷ The project's costs could increase further based on the outcome of pending lawsuits against MTA filed by retailers affected by ground settlement along Hollywood Boulevard and from the construction contractor that was fired by MTA for inadequate construction techniques.

MTA currently plans to fund \$3.4 billion of the \$6.1 billion with federal funds. The federal funds anticipated, which are subject to annual appropriations, include \$2.8 billion from three full-funding grant agreements, \$500 million from other federal programs, and \$100 million that MTA plans to request above the current federal commitment for segment three as part of the reauthorization of ISTEA.

However, the additional \$100 million federal contribution will not be sufficient to address the project's funding shortfall. The project currently has an estimated shortfall of \$335 million resulting from federal, state, and local commitments that may not be realized:

- In fiscal years 1995, 1996, and 1997, the Congress did not provide for the annual commitments identified in the grant agreements, resulting in a funding shortfall of \$184 million. MTA officials told us that if they continue to receive half or less of the yearly commitment in the grant agreements,

¹⁷The three alignment options being considered range in cost from \$167 million to \$279 million.

the federal shortfall could reach \$580 million or more by 2002.

- As we reported in May 1996, the California state legislature diverted \$50 million in funds slated for MTA's bus operations.¹⁸ Because the legislature specified that the shortfall could not affect the bus program, MTA transferred \$50 million to bus operations that had been committed to the Red Line project.
- Some of MTA's local revenue commitments may also not be realized. While the City of Los Angeles plans to honor its commitment to fund \$200 million toward the completion of segment three, MTA will no longer require the City to fund \$65 million of the cost increase on segment two resulting from the collapse of Hollywood Boulevard into the subway tunnel. Furthermore, MTA does not expect to receive \$36 million of the \$75 million in estimated revenues from assessments levied on retail properties adjacent to planned stations because some retail property owners oppose the assessment.

Additional problems could further impact MTA's ability to finance the Red Line and other transportation projects. First, projected local sales tax revenues have declined, resulting in \$400 million less in revenues than expected through 2010. Second, in October 1996, the bus riders union (and others) and MTA entered into an agreement that requires MTA to—among other things—expand its bus service.¹⁹ MTA has estimated that implementing the agreement will cost \$480 million through 2010. Finally, if MTA realizes its projected federal shortfall of \$580 million, MTA's overall funding shortfall could reach \$1.5 billion for all of its projects, which may affect its funding commitments to both the Red Line and the Alameda Corridor Project, which I will discuss in the next section. MTA is reevaluating its existing funding commitments and plans to report to its Board of Directors in June 1997 on a revised financial plan, which would include recommendations on how to meet its commitments.

On January 6, 1997, FTA took a number of steps to address MTA's funding shortfall, including requiring MTA to develop a recovery plan and hiring a financial management consultant to review and report on MTA's financial

¹⁸Los Angeles Red Line: Financing Decisions Could Affect This and Other Los Angeles County Rail Capital Projects (GAO/RCED-96-147, May 14, 1996).

¹⁹The agreement also requires MTA to freeze the general base fare at \$1.35 and offer an \$11 weekly bus pass, both for 2 years, and add 102 more buses and 50 more limited-service vehicles to the street over the next 2 years.

capacity.²⁰ MTA's recovery plan, which impacts only segment three, assumes annual federal funding of \$100 million and proposes a transfer of \$300 million in flexible federal funds from the high-occupancy-vehicle program to the rail program. Additionally, the plan proposes a 2-year delay and \$69.3 million increase for the East Side extension and a 10-year delay and \$192 million increase for Mid City.

The increased budgets and delayed schedules outlined in MTA's recovery plan would require that FTA and MTA renegotiate the full-funding grant agreement for segment three. MTA's recovery plan assumes that the \$261 million budget increase for segment three will be paid from local funds, as we mentioned earlier. MTA officials have subsequently told us that they plan to seek \$100 million in additional federal funding for segment three in the reauthorization of ISTEA.²¹ According to MTA officials, the delays to Mid City are due to technical problems that could justify additional federal funding. However, FTA officials told us that they will use their analysis of MTA's recovery plan, along with the financial management consultant's report, to assist them in assessing MTA's financial capacity to fund the Red Line Project.

Financing Issues Unresolved for the Alameda Corridor Project

Financing uncertainties could also be an issue for the Alameda Corridor intermodal project, a 20-mile freight rail corridor that the cities of Los Angeles and Long Beach plan to construct from their respective ports to central rail yards near downtown Los Angeles. When completed in 2001, the project will consolidate all rail traffic into a new rail corridor, increase trains' average speed from 10 to about 40 mph, and reduce much of the existing congestion in the corridor caused by nearly 200 grade crossings. These upgrades are also intended to accommodate the continued growth in commercial trade flowing into the ports from Pacific Rim nations.

As of February 1997, about 5 percent of the project had been constructed, and the total estimated cost is expected to be about \$2 billion. The project will be paid for using federal, state, and local funds, as well as revenue bonds issued by the Alameda Corridor Transportation Authority. Over \$850 million in funding for the project has been secured: \$407 million from the ports to purchase the right-of-way for the new rail line, \$400 million from the federal government in the form of a direct loan, and an additional \$47 million in federal grants. As for the remaining funds, about \$711 million is to come from revenue bonds that will be issued in 1998 by the Alameda Corridor Transportation Authority; about \$347 million from

²⁰The financial management consultant must submit his report to FTA no later than March 31, 1997.

²¹MTA also plans to request \$100 million for further extensions to the current project.

the Los Angeles County MTA; and about \$60.5 million, from the state. Although the state funds appear to be secure, it is unclear if the project will receive the full-funding commitment from MTA or be able to raise the \$711 million in revenue bonds.

Project officials state that MTA's ability to meet its funding commitment is uncertain. Although MTA has identified a bond, secured by a local sales tax, as the potential source for funding its commitment to the project, these tax revenues are projected to decline. In addition, a bond rating agency stated that the Alameda Corridor Transportation Authority's bond would likely be investment grade, but the agency cited several factors that could affect the project's ability to secure the \$711 million needed. First, the project has asked the Internal Revenue Service to allow it to issue tax-exempt revenue bonds—a ruling that would make the bonds more attractive in bond markets and reduce the project's overall level of debt. Project officials estimated that without this tax-exempt status, they would have to issue more than \$800 million in bonds to meet the same level of debt financing. Second, a bond rating agency stated that its assessment of the risk associated with the project's ability to repay the bonds will affect the project's credit rating and the interest rate of the bonds, influencing their attractiveness to investors. Current risk factors include the capacity of the prime contractors to complete a complex construction project within the estimated costs; the potential diversion of funds from the ports to the cities of Los Angeles and Long Beach; and the potential for further litigation by two smaller cities that will be affected by the project's construction.

The potential diversion of funds is important because between 1992 and 1994, the state allowed Los Angeles and Long Beach to divert \$90 million from their ports to the cities' general funds, causing a bond rating company to lower the bond rating of the Port of Long Beach. The ports are required to repay 40 percent of the principal and interest associated with the revenue bonds as well as the federal loan. (The railroads are responsible for the remaining 60 percent.)

According to a project official, the project will use the \$400 million federal loan to pay for engineering, design, and initial construction costs. Federal officials stated that the federal loan will improve the project's credit rating both by decreasing the revenue bonds needed and serving as a general sign of federal commitment to the project. The federal loan is subordinate to the revenue bonds, which means the revenue bonds will be paid off first

if funding is limited, thus increasing the attractiveness of the revenue bonds to investors but posing a greater risk to the federal government.

FHWA officials have cited the Alameda Corridor's federal loan as a precedent for future financing efforts. Officials noted that FHWA used the project as a model in the agency's effort this year to create the new \$100 million Transportation Infrastructure Credit Program. The program is intended to leverage federal funds and provide credit to assist nationally significant projects, particularly large multimodal, revenue-generating projects. However, since the Alameda Corridor project is in its early stages, there are a number of unanswered questions concerning the risk to the federal government if other funding sources are not realized and the success of this type of federal loan at leveraging other funding.

Federal Commitment to Transit Capital Funding Is Mortgaging Future "New Starts" Funds

As of February 1997, FTA had signed full-funding grant agreements with 13 projects, and two additional projects, including BART's airport extension, had agreements pending. The outstanding commitments on these 15 projects totaled about \$3.75 billion. These projects are generally in the final design or the construction phase when they request federal funding commitments through a full-funding grant agreement under FTA's New Starts Program.

Although the authorization period for FTA's New Starts Program ends in October 1997, FTA is allowed to make contingent commitments to projects with full-funding grant agreements beyond the authorization period. The ceiling for these commitments is determined by combining the remaining unobligated authorization under ISTEA—\$1.7 billion as of October 1, 1996—with one-half of the estimated remaining unobligated balance in the mass transit account of the Highway Trust Fund at the end of the authorization period—\$2.8 billion as of October 1, 1996.²² This provided FTA with sufficient authority to cover commitments made or planned for the 15 projects with or projected to have full-funding grant agreements.

By using this commitment authority, the FTA has essentially mortgaged future federal New Starts funds because it will take until 2003 to fulfill existing and pending full-funding grant agreements if the Congress continues to fund these projects at about the same level provided over the last few years—about \$800 million. Assuming no increase, it is unlikely that new projects would be able to compete for federal New Starts funds until that time; at the beginning of the fiscal year, there were 11 projects

²²In addition, ISTEA specified that commitments to BART's airport extension program be made from the entire unobligated balance of the mass transit account.

that were nearing the stage in the investment cycle at which projects request such federal funding.²³ This also raises a number of questions regarding existing commitments. For example, will other full-funding grant agreements, like the one for the Los Angeles Red Line project, be subject to renegotiation for increased costs or delays? It appears that increased funding, if requested, for ongoing projects may not be possible given existing commitments. Furthermore, extending the deadline for existing projects commits federal funds for those projects further into the future, narrowing the possibility that new projects will be funded. Given that funds may not be available under the New Starts Program, it may be a signal to state and local governments that they need to look for less costly alternatives to meet their transportation needs or build them without federal capital assistance.

Issues Concerning ITS' Deployment

Established by ISTEA in 1991, DOT's ITS program has received federal funding totaling \$1.3 billion to advance the use of computer and telecommunications technology that will enhance the safety and efficiency of surface transportation. We reported to this Subcommittee last week on the progress states and localities had made in deploying ITS and identified options the federal government could consider to facilitate deployment.²⁴ Although the program envisioned widespread deployment of an integrated multimodal ITS, this vision has not been realized for several reasons. First, the ITS national architecture was not completed until July 1996, and a 5-year effort to develop technical standards is planned for completion in 2001. The ITS architecture and technical standards, which define ITS components and how they will work together, are prerequisites to large-scale integrated deployment of ITSS. In addition, the lack of knowledge of systems integration among state and local officials, insufficient data documenting the cost-effectiveness of ITS in solving transportation problems, and competing priorities for limited transportation dollars will further constrain widespread deployment of ITS.

DOT's fiscal year 1998 budget includes \$250 million for ITS and proposes to focus the federal funds on deploying it. However, our review has shown that federal leadership in providing nonfinancial and financial incentives to overcome barriers may be needed to facilitate further deployment. The nonfinancial incentives that the federal government can offer include

²³FTA has requested \$634 million for fiscal year 1998. If appropriated at this level, it could exacerbate the situation.

²⁴Urban Transportation: Challenges to Widespread Deployment of Intelligent Transportation Systems (GAO/RCED-97-74, Feb. 27, 1997).

providing technical assistance and training to state and local officials, disseminating information on the costs and benefits of ITS efforts, and completing the development of technical standards in a timely manner.

Our interviews with transportation officials in 10 of the nation's largest urban areas revealed a wide variety of opinions on the appropriate federal role for funding ITS' deployment. Officials in six urban areas stated that federal funding of \$1 billion each year would be needed to achieve widespread deployment of ITS technologies. They added that in light of other pressing transportation priorities, additional investments in ITS might not occur without substantial federal financial assistance. In contrast, officials from four other urban areas opposed a large-scale federal-aid program because they do not want additional federal funding categories. Some of these officials also said that such a program could drive unnecessary investments in ITS, as decisionmakers chased ITS capital money, even though another solution might have been more cost-effective. In the absence of a large federal program, officials from 5 of the 10 urban areas supported a smaller-scale federal seed program. They said that such a program could be used to fund experimental ITS applications, promote better working relationships among key agencies, or support information systems for travellers. The current limitations to deploying ITS in urban areas, as well as budgetary constraints, are considerations for this Subcommittee as you consider DOT's fiscal year 1998 request for the ITS program.

Few Budgetary Savings Have Occurred Through Surface Field Office Consolidation/Colocation

In testimony before this Subcommittee in February 1995, we stated that opportunities existed for budgetary savings from the proposed consolidation of DOT's five surface operating administrations into one by, among other things, consolidating the extensive field office structure—161 offices at that time.²⁵ We also suggested that if the departmental reorganization did not occur, there still might be opportunities to streamline the field structure through colocation. We noted that colocation can reduce such administrative costs as reception, printing, mailing, and copying. We cited Denver, Colorado, as an example of an opportunity for colocation because DOT's modal agencies have seven field offices in the metropolitan area.

Since that time, the overall departmental reorganization is no longer on the table, and DOT is not currently examining options for consolidating its

²⁵Surface Transportation: Reorganization, Program Restructuring, and Budget Issues (GAO/T-RCED-95-103, Feb. 13, 1995).

surface field office structure. However, DOT has established a Colocation Task Force to identify opportunities for its modal agencies, including FAA and the Coast Guard, to colocate field offices within a metropolitan area to improve the delivery of services by providing “one-stop shopping” for customers and reduce overhead costs. The task force has initially identified 160 field offices that could be colocated into 60 locations. The results of its initial evaluation of these offices is due this summer and will be reviewed by the Secretary’s Management Council.

The task force is using lease expiration dates for existing office space or the date of completion of new office space as a trigger for its assessment of specific locations. Decisions will be made on the actual extent of colocation based on these specific assessments. One colocation occurred recently when the NHTSA office in Hanover, Maryland, moved in with FHWA’s regional office in Baltimore. Another colocation under consideration is in Kansas City, Missouri, because the new FAA regional center is scheduled to open there in 1998. DOT is currently assessing the costs and benefits of housing all DOT field staff in that area in the new regional center. Issues of concern include lease costs in downtown office buildings that are higher than those currently paid in suburban locations and the possibility that customers of FHWA, FRA, FTA, and NHTSA may not all be located nearby.

DOT officials told us that their efforts are currently focused on service delivery and customer satisfaction and that this focus may result in increasing the costs of the field structure. For example, recently established metropolitan field offices established to better serve urban customers in New York, Philadelphia, Chicago, and Los Angeles will cost more money rather than save it because FHWA, in particular, does not have field offices in these cities, and the new offices will be in addition to existing FHWA field offices. However, while their focus has been on improved service delivery, DOT officials have taken actions to reduce costs. For example, they explained that they have closed seven small FRA inspection offices and 5 Inspector General locations because staff, while still located in each of these areas, are using either telecommuting centers or their residences as a base of operations. Furthermore, FHWA has consolidated financial, personnel, and data processing support among its nine regions rather than have that support in each region.

Other Major Issues

In addition to the safety and security and management issues facing DOT, there are three other areas we would like to discuss—financing FAA,

Amtrak's financial condition, and the effectiveness of the Coast Guard's drug interdiction efforts.

Financing FAA

One of the most critical issues confronting DOT and the Congress is how to adequately fund FAA to meet its mission over the long term. The Congress has recognized the seriousness of FAA's long-term financing problems and directed that, among other things, an independent assessment of FAA's financial requirements be completed and that the National Civil Aviation Review Commission be created to recommend to the Secretary of Transportation by August 1997 how best to finance the agency in light of, among other things, the independent assessment.²⁶ Additionally, the Congress required that we assess (1) how ATC costs are allocated between FAA and DOD and (2) airport capital needs, and that we report to the Congress by April 1997. We are also required to report to the Commission so it can use the results of our work in its assessment.

It will take some time for the Commission to complete its work and the Congress and the administration to assess it. Until then, we will not know the full extent of FAA's financing problems and how they could be addressed. However, FAA has included some estimates of the magnitude of the problem in its fiscal year 1998 budget submission. FAA projects about a \$9 billion shortfall between its existing requirements and projected funding levels through 2002, as illustrated in the following table.

²⁶Under the Federal Aviation Reauthorization Act of 1996, after receiving the national commission's report, the Secretary of Transportation is required to consult with the Secretary of Treasury and report to the Congress by October 1997 on the Secretary's recommendations for funding the aviation system through the year 2002.

Table 1: FAA's Projected Budget Shortfall, 1998-2002

Dollars in billions			
Fiscal year	FAA's estimated requirements ^a	FAA's projected budget ^b	FAA's budget shortfall
1998	\$ 8.46	\$ 8.46	\$ 0
1999	10.82	8.68	2.14
2000	11.22	8.91	2.31
2001	11.32	9.15	2.17
2002	11.50	9.39	2.11
Total	\$ 53.32	\$ 44.59	\$ 8.73

Source: FAA and the President's 1998 budget.

^aRequirements for fiscal year 1998 are requested budget authority in the President's 1998 budget. Requirements for fiscal years 1999-2002 are FAA's estimates.

^bBudget estimates for fiscal years 1998-2002 come from the President's 1998 budget.

A significant amount of the \$9 billion shortfall would occur in FAA's operations account. The shortfall in this account is primarily attributable to increases in safety staffing, including new controllers, flight standards inspectors, certification personnel, and field maintenance technicians. Higher employee salaries and health care expenses also contribute to FAA's estimated gap in funding. The remainder is primarily due to increased facility and equipment requirements needed to transition to free flight (a system of air traffic control where pilots choose their own routes, rather than having it specified by FAA) and improve airport security. The growth in FAA's requirements for facilities and equipment translates to a 38-percent increase in 1999 over the 1998 requested level.

FAA officials estimate that this \$9 billion potential shortfall could increase by an additional \$4 billion as the agency tries to address the Gore Commission recommendations to accelerate modernization of the National Airspace System. This increase will be reflected in the facilities and equipment account. FAA expects to have a complete estimate of these costs later this year.

While we do not disagree that FAA faces significant financial problems, we cannot quantify how severe the problems will be. We do know that FAA's analysis presumes that the agency will not realize any productivity gains—through technological advances, new operational concepts, or other initiatives—that will enable it to reduce its controller or

noncontroller workforces or prevent operating costs from growing at the projected rate of 7 percent annually.

Amtrak's Financial Condition

Over the last several years, we have issued a number of reports and testified several times on Amtrak's financial condition, and we continue to monitor Amtrak's efforts to address its financial problems.²⁷ Amtrak's passenger rail service has never been profitable and, through fiscal year 1997, the federal government has provided Amtrak over \$19 billion for operating and capital expenses. In response to continually growing losses and a widening gap between operating deficits and federal subsidies, Amtrak developed strategic business plans in 1995.²⁸ These plans, which have been revised several times, were designed to increase revenues and control cost growth and, at the same time, eliminate Amtrak's need for federal operating subsidies by 2002.

Our preliminary assessment of Amtrak's financial condition is that, despite some gains, the corporation is still in a very precarious position. It remains heavily dependent on federal support to meet its operating and capital needs. Although actions taken by Amtrak through its business plans have helped reduce its net losses, the corporation has struggled to reach operating loss targets. As a result, greater than expected losses have made it difficult for Amtrak to continue its path toward eliminating federal operating support. While Amtrak narrowed the gap between its operating deficit and the federal operating subsidy in fiscal year 1995, this gap grew again in fiscal year 1996. In fiscal year 1996, the net loss was \$764 million, and the gap between the operating deficit and federal operating support was \$82 million.

In part to make up the operating and capital shortfalls, Amtrak has borrowed heavily since 1993. From fiscal years 1993 to 1996, Amtrak's debt and capital lease obligations nearly doubled—from about \$527 million to about \$987 million (in 1996 dollars). These debt levels do not include an additional \$1 billion expected to be incurred beginning in 1999 to finance 18 high-speed train sets and related maintenance facilities for the Northeast Corridor and the acquisition of new locomotives.

²⁷Amtrak's Strategic Business Plan: Progress to Date (GAO/RCED-96-187, July 24, 1996); Northeast Rail Corridor: Information on Users, Funding Sources, and Expenditures (GAO/RCED-96-144, June 27, 1996); Amtrak: Early Progress Made in Implementing Strategic Business Plan, but Obstacles Remain (GAO/T-RCED-95-227, June 16, 1995); Intercity Passenger Rail: Financial and Operating Conditions Threaten Amtrak's Long-Term Viability (GAO/RCED-95-71, Feb. 6, 1995).

²⁸Net loss is defined as total revenues minus total expenses. Operating deficit is the same as net loss, except non-cash items (such as depreciation) are excluded from total expenses.

It is important to note that Amtrak's increased debt levels could limit the use of federal operating support to cover future operating deficits. In fact, over the last 4 years, interest expenses have tripled—from \$20.6 million in fiscal year 1993 to \$60.2 million in fiscal year 1996. Since Amtrak pays interest from federal operating assistance and principal from federal capital grants, this increase has also absorbed more of the federal operating subsidy each year. Between fiscal years 1993 and 1996, the percentage of federal operating subsidies accounted for by interest payments has increased from 6 percent to 21 percent. As Amtrak assumes more debt to acquire equipment, the interest payments are likely to continue to consume an increasing portion of federal operating subsidies.

Implementation of its strategic business plans, including reducing some routes and services, cutting management positions, and raising fares, appears to have helped improve Amtrak's financial condition. However, planned net loss targets have frequently been missed. To illustrate, Amtrak's plans for fiscal years 1995 and 1996 included actions to reduce the net losses by \$195 million—from about \$834 million in fiscal year 1994 to \$639 million in fiscal year 1996. However, actual net losses for this period were about \$127 million more than Amtrak had planned. Amtrak's fiscal year 1997 net losses are expected to be even higher than those for fiscal year 1996. Largely as a result of increased costs from postponed route and service actions, Amtrak's planned year-end net loss has been revised upward to \$762 million from the originally projected \$726 million. Furthermore, Amtrak projects that its net loss could be as high as \$786 million if unanticipated expenses and revenue shortfalls should occur.

Amtrak's goal of eliminating federal operating subsidies by 2002 is heavily dependent on capital investment. Such investment—the modernizing of property, plant, and equipment—will not only help Amtrak to retain revenues by improving the quality of service but will potentially increase revenues by attracting new riders. Amtrak's capital investment needs are great, both to replace and modernize the current physical assets and to complete new projects such as high-speed rail service in the Northeast Corridor. For example, in May 1996, FRA and Amtrak estimated that about \$2 billion would be needed over the next 3 to 5 years to recapitalize the south end of the corridor and preserve its ability to operate in the near-term at existing service levels. FRA and Amtrak estimate that up to \$6.7 billion may be needed over the next 20 years to recapitalize the entire corridor and make improvements targeted to respond to high-priority

opportunities for growth. Finally, Amtrak estimates an additional \$1.4 billion will be needed to complete the high-speed rail project.

Our ongoing work indicates that Amtrak has made some progress in addressing capital needs, but the going has been slow, and in some cases, Amtrak may be facing significant future costs. For example, in October 1996 about 53 percent of Amtrak's active fleet of 1,600 cars averaged 20 years old or more and were at or approaching the end of their useful life. It is safe to assume that as this equipment continues to age, it will be subject to more frequent failure and require more expensive repairs.

Finally, Amtrak will continue to find it difficult to take those actions necessary to further reduce its costs. For example, Amtrak has been unsuccessful in negotiating productivity improvements with labor. Such improvements were expected to save about \$26 million in fiscal year 1995 and another \$79 million in fiscal year 1996. According to an Amtrak official, over the last 2 years Amtrak has not aggressively pursued negotiations with labor unions over productivity improvements. And Amtrak's ability to make route and service adjustments remains an outstanding issue.

Amtrak's financial future has been staked on its ability to eliminate federal operating support by 2002 by increasing revenues, controlling costs, and providing customers with high-quality service. Although its strategic plans have helped reduce operating losses, Amtrak continues to face significant challenges in accomplishing this goal, and it is likely that Amtrak will continue to require federal financial support—both operating and capital—beyond that time frame.

Coast Guard's Antidrug Efforts

In its fiscal year 1998 budget request, the administration is asking for \$389 million for operations related to the Coast Guard's drug interdiction efforts, a \$53 million increase over 1997 levels. Mr. Chairman, late last year, you and Representative Porter asked us to assess the Coast Guard's progress in developing an approach to drug interdiction that conforms with the principles of the Government Performance and Results Act (GPRA).²⁹ We plan to report to you later this month, but we would like to share our preliminary findings.

²⁹P.L. 103-62.

GPRA calls for federal agencies to pay more attention to the results of their programs, a departure from focusing on such measures as staffing and activity levels. GPRA requires agencies to (1) develop results-oriented performance goals, (2) identify ways to achieve them, and (3) disclose key factors that could keep them from meeting their goals. The Coast Guard has made a start at meeting these requirements for its drug interdiction efforts, but Coast Guard officials acknowledge they must overcome obstacles in all three areas if they are to be in compliance by 1999, when the act's requirements become fully effective.³⁰

Thus far, the Coast Guard has defined its performance goal as “reducing the amount of illegal drugs entering the country through maritime routes by 25 percent over five years.” The preliminary goal represents a start toward conformance with GPRA in that it covers the required time (5 years) and is results-oriented. It remains to be seen, however, whether this goal can be effectively measured. Simply reporting the amount of drugs seized or deterred is not enough. Gauging effectiveness means comparing such information against a measure of supply—how much smugglers tried to ship or how much still got through. The Coast Guard's approach calls for making such comparisons, but the illegal nature of drug trafficking makes obtaining reliable estimates of supply difficult. An interagency effort sponsored by the Office of National Drug Control Policy has made some progress in developing estimates on the amount of cocaine entering the United States. According to Coast Guard officials, a similar effort is under way for estimating heroin traffic.

A related obstacle is the difficulty of separating the impact of the many agencies involved in drug control. For example, a decrease in the amount of drugs entering the United States through maritime routes could also be the result of greater efforts to control drugs in the source country, better intelligence from other U.S. agencies, or lower domestic demand due to agencies' efforts to reduce it.

Coast Guard officials indicated that reducing the amount of illegal drugs entering the United States via maritime routes largely depends on resources. They expect that additional resources will allow a higher “contact rate” with ships and planes in targeted areas, which in turn will

³⁰GPRA requires agencies to develop a strategic plan by the end of fiscal year 1997 and a performance plan by the end of fiscal year 1999. The strategic plan identifies long-term goals and describes how the agency intends to meet them; the performance plan provides the linkage between the strategic goals and what managers and employees do day-to-day, including specific performance goals and performance measures.

provide greater deterrence.³¹ In the complex world of drug control efforts, however, a key obstacle for the Coast Guard is establishing a clear case that spending these additional resources can effectively contribute to the Office of National Drug Control Policy's mission of reducing drug use and its consequences. In this regard, a recent study conducted by the Office sounded a cautionary note. The study concluded that the effect of greater expenditures in the "transit zone" where the Coast Guard's efforts are currently concentrated does not seem significant enough to affect U.S. drug use.³² It suggested considering whether the investment of a similar level of resources elsewhere in the drug strategy might produce more benefits. However, the study is hardly the last word on the issue. It has a number of methodological limitations, and Coast Guard officials point out that a small investment in the transit zone (about 1.6 percent of the total federal budget at the time of the study) would produce an 11-percent reduction (90 metric tons) in drug traffic.

Coast Guard officials acknowledge that factors other than funding affect their success in stopping maritime drug smuggling. One factor is the large geographic area that must be covered. Unlike in the Caribbean, where specific paths for smuggling have been identified, in the eastern Pacific Ocean, the large area makes deterrence and interdiction more difficult. Another factor is smugglers' increasing technological sophistication. For example, by using global positioning system technology to set airdrop coordinates prior to departure, smugglers can reduce radio communications, making it harder for the Coast Guard to detect them. To comply with GPRA, the Coast Guard may need to identify such factors.

This concludes our prepared statement. We will be happy to respond to any questions that you or other Members of the Subcommittee may have.

³¹The Coast Guard defines "contact rate" as the frequency of contact with maritime traffic in targeted areas. According to Coast Guard officials, the agency currently has a contact rate of 12 percent, which they believe deters or interdicts 29 percent of the smugglers using maritime routes. They believe that a contact rate of 40 percent will deter or stop smugglers in 90 percent of the cases in high-risk areas. The amount of resources needed to raise the contact rate to 40 percent is unknown.

³²The National Drug Control Strategy, 1996: Program, Resources, and Evaluation, Office of National Drug Control Policy (Washington, D. C.: Apr. 1996), pp. 48-51. The transit zone where the Coast Guard's efforts are concentrated includes the Caribbean Sea, the Gulf of Mexico, Central America, Mexico, and the Eastern Pacific.

Ongoing Air Traffic Control Modernization Projects: Status and Issues

For several major modernization projects, the Federal Aviation Administration (FAA) has made progress in fielding equipment. For example, about 6 months ago we reported on FAA's effectiveness in acquiring an interim replacement for its Display Complex Channel (DCC), an aging system that was the subject of much media attention because of outages at a Chicago air traffic control (ATC) facility.¹ At that time, we concluded that FAA was on course to deliver this system, known as DCC Rehost, or DCCR, on time and within its budget. Since then, FAA has installed and is operating DCCR at the first site (Chicago) ahead of schedule, and it has reported that DCCR is \$3 million under its budget.

We see several reasons why this acquisition has enjoyed so much success when others have been so problematic. First, this acquisition was relatively small, involving comparatively little in the way of new software development, and equipment delivery was relatively quick. Second, it was well defined. That is, most of its requirements were embedded in the existing DCC and thus were well understood and primarily involved transferring these functions to new hardware. Third, the project management team instilled discipline into its acquisition strategy. For example, it defined and followed structured risk management and quality assurance programs, both of which are invaluable in systems development and acquisition. As such, it was a sharp departure from past ATC projects, like the Advanced Automation System (AAS), which were very large, scheduled for delivery years in the future, characterized by poorly understood and poorly controlled requirements, and managed without discipline.

In addition, since we testified last March, FAA has commissioned 11 Terminal Doppler Weather Radars, bringing the total commissioned to 22 of the 45 systems planned. Of the 23 remaining systems, 18 are expected to be commissioned by the end of July 1997, and 5 are designated for storage until the agency resolves problems acquiring needed parcels of land. After 8 years of delays, in early 1996 FAA commissioned the first of 40 planned long-range radars—called Air Route Surveillance Radar-4s. Since last year, FAA has commissioned 12 additional radars. According to the current plans, all but seven of the remaining radars will be commissioned by February 1998, though the dates have yet to be determined because FAA needs to resolve environmental concerns at one site and scheduling issues at six others. Since last year, FAA has commissioned 13 additional Voice

¹Air Traffic Control: Good Progress on Interim Replacement for Outage-Plagued System, but Risks Can Be Further Reduced (GAO/AIMD-97-2, Oct. 17, 1996).

Switching and Control Systems, completing the commissioning of all 21 systems.

FAA continues to work on the Display System Replacement (DSR) project, which will provide controllers in en route ATC facilities² with new work stations. According to FAA, the cost remains at about \$1 billion, and the schedule still calls for making the system operational at the first site by October 1998. DSR work stations are in full production, and all equipment needed for operations at the first site—Seattle—was delivered 8 months early. FAA's testing of the system software is scheduled to be completed in mid-March 1997. Currently, FAA foresees no major problems with software.

For the major acquisitions we track, however, most will not be completely fielded until the year 2000 and beyond (see app. II). In addition, costs for 8 projects increased, resulting in a total of \$194 million in additional costs. Details on certain key acquisitions are provided in appendix III.

Standard Terminal Automation Replacement System

In September 1996, FAA contracted with Raytheon Corporation to develop, produce, and implement the Standard Terminal Automation Replacement System (STARS). This project is designed to replace 15- to 25-year-old computers, controller work stations, and related equipment at about 170 FAA terminal ATC facilities between December 1998 and February 2005. FAA currently estimates that STARS will cost about \$2.2 billion, including \$940 million for facilities and equipment and about \$1.3 billion to operate and maintain the system over its life.

FAA's cost estimate for STARS has the potential to grow by as much as \$500 million, according to a September 1996 analysis that projected future operations and maintenance costs. On the basis of more current information, project officials told us that there may be some minor cost growth but they could not provide us with an updated estimate or detailed support for their views. FAA will also incur costs to make STARS operational. FAA expects to spend at least \$18 million to get about 50 facilities ready to accept STARS equipment. This estimate is expected to grow as FAA develops cost estimates for site preparation of the 120 remaining facilities.

Regarding the STARS schedule, we found that it is attainable only if FAA successfully mitigates certain risks. For example, FAA has yet to secure all stakeholders' commitment to the schedule. The schedule anticipates that

²The primary role of the en route centers is to direct traffic in air routes outside of terminals' airspace and throughout the national airspace.

the contractor will install and deploy most STARS equipment with support and oversight provided by FAA's Airway Facilities Service. However, the Airway Facilities Service at the regional level has not agreed to the installation plan because it is still uncertain of its role. Furthermore, the workforce's union has not been briefed on the plan and is concerned about its effect on their members' job security. Also, FAA must resolve scheduling conflicts between STARS and other modernization efforts. For example, the original schedule for deploying STARS at the first 45 sites presented 12 potential conflicts where equipment was due to be delivered during facility renovation or replacement.

Additionally, if FAA and its contractor experience difficulties in software development, STARS' implementation—particularly at the three facilities targeted for operating it before fiscal year 2000—will likely be delayed. FAA and Raytheon expect to use commercial off-the-shelf computer hardware and some previously developed software for STARS. However, a software development effort is still required. FAA does not expect to complete testing of the initial STARS' software until September, 1998, and the full software until July, 1999. As recently as December 1996, FAA and Raytheon were discussing how the system would provide specific functions and what functions would be needed. These discussions resulted in agreement on 28 outstanding issues. Overall, FAA estimates that some 140,000 lines of new code will need to be written. For example, some 2,000 lines of new code are needed to fulfill safety requirements such as warning controllers when aircraft are not maintaining proper separation or minimum safe altitudes.

FAA is aware that these risks must be mitigated and has begun several initiatives. While such actions are encouraging, it is too early to tell how effective they will be.

The Global Positioning System

FAA faces important planning, technical, and funding issues in augmenting the Global Positioning System (GPS)³ for civil aviation purposes. Within the past year, FAA has established a team and developed a road map for managing the development and implementation of the agency's Wide Area Augmentation System (WAAS). The agency also addressed problems with contractor performance by terminating the original contract for procurement of the WAAS and immediately signing another.

³GPS satellites transmit radio signals that allow properly equipped air, land, and sea users to calculate the time and their position and speed anywhere above the earth's surface and in any condition.

For the Local Area Augmentation System (LAAS), which will enable GPS to be used for the most demanding precision approaches, FAA has signed two contracts for system development activities.⁴ It has not, however, completed schedule and cost estimates for the LAAS, as we recommended in 1995, because the agency has not decided whether it will fully fund the development, procurement, and maintenance of this system.⁵ The agency may turn these responsibilities over to individual airports. FAA expects to complete an investment analysis by mid-1997 to determine how LAAS should be financed.

FAA's plans for LAAS need to be definitive as soon as possible for two major reasons. First, as emphasized by the Air Transport Association at a congressional hearing on November 30, 1995, the timing of the agency's efforts will impact the production of GPS avionics and the retrofitting of aircraft. Second, these plans will also clarify when FAA could expect to begin decommissioning its instrument landing systems (ILS), for which FAA spends substantial resources for operation and maintenance. We reported last year that some 120 ILSs are over 20 years old and experience twice the number of outages as expected under current design standards.⁶ If FAA shifts to airports the responsibility for acquiring LAAS, FAA will be in the position of maintaining the existing ILSs until the airports decide to install LAAS.

Recent events have confirmed our long-standing concerns about technical issues that put FAA's schedule for augmenting GPS at risk. In 1994, in response to recommendations from government and industry groups, FAA accelerated its schedule from 2000 to 1997 for civil aircraft to be able to use the augmented GPS domestically as a "primary means" of navigation—in other words, not relying on other navigation aids. In 1995, we reported that FAA would probably not meet the 1997 milestone. Delays were realized this past year when FAA announced that the WAAS would not provide this primary means capability until late 1998 at the earliest. The delays occurred because (1) FAA underestimated the technical challenges involved in achieving the performance requirements for the system's availability, accuracy, and integrity and (2) the initial contract for WAAS was terminated when FAA became convinced that the contractor could not achieve cost, schedule, and performance goals.

⁴The local system will use ground-based communications equipment to augment the signals in the airspace around airports so that aircraft can land in the worst weather conditions.

⁵National Airspace System: Comprehensive FAA Plan for Global Positioning System Is Needed (GAO/RCED-95-26, May 10, 1995).

⁶Global Positioning System Augmentations (GAO/RCED-96-74R, Feb. 6, 1996).

Appendix I
Ongoing Air Traffic Control Modernization
Projects: Status and Issues

Funding has also become a significant issue for both WAAS and LAAS. In 1995, we reported that FAA had not yet developed information on the funding required to implement the WAAS. In early 1996, FAA approved a cost baseline for WAAS: \$556 million in facility and equipment costs and \$9 million in operations and maintenance costs. However, by mid-1996 FAA officials began expressing concern about the agency's ability to keep costs within those baselines. Recent interviews with agency officials and internal documents point to the potential for substantial increases in cost estimates. FAA is now reevaluating its cost baselines and expects to issue a revised baseline this spring. Regarding LAAS, funding concerns have been the primary reason why FAA has considered turning over the responsibility for acquisitions and maintenance to individual airports. As noted above, FAA expects to make a decision on LAAS' financing later this year.

Status of FAA'S Major Modernization Projects

Major projects	Last-site implementation			Number of operational systems		
	Year		Years delayed	Planned	Commissioned	
	Original estimate	1997 estimate			Since 2/96	Current total
Aeronautical Data Link (ADL)	1998	TBD	N/A	20 DLAPs/ 57 TDLS ^a	3	57
Air Route Surveillance Radar-4 (ARSR-4)	1991	^b	^b	40 radars	13	13
Airport Surface Detection Equipment-3 (ASDE-3)	1990	1999	9	38 radars	6	26
Airport Surveillance Radar-9 (ASR-9)	1992	1998	6	120 radars	9	111
Automated Surface Observing System (ASOS) ^c	1997	2001	4	574 units	87	133
Enroute Automation—Display System Replacement (DSR)	2000 ^d	2000	N/A	21 systems	0	0
Integrated Terminal Weather System (ITWS)	2000	2003	3	34 systems	0	0
Mode Select	1993	1999	6	144 systems ^e	34	71
Oceanic Automation Program (OAP)	^f	2000	N/A	3 systems	0	0
Operational Supportability and Implementation System (OASIS)	^f	2001	N/A	61 systems	0	0
Terminal Air Traffic Control Automation (TATCA)	^f	^g	N/A ^g	N/A	N/A	N/A
Terminal Automation—STARS	2003	2005 ^h	2	171 systems	0	0
Terminal Doppler Weather Radar (TDWR)	1998	^f	N/A	45 radars	11	22
Terminal Radar Digitize, Replace and Establish (TRDRE)	N/A	2004	N/A	112 radars ⁱ	0	0
Tower Automation Program	2000	^j	N/A	TBD	N/A	N/A
Voice Switching and Control System (VSCS)	1992	1997	5	21 units ^k	13	21
Weather and Radar Processor (WARP)	N/A ^l	2000	N/A	21 units	0	0
Wide Area Augmentation System (WAAS)	2001	2001 ^m	N/A	1 system	0	0

(Table notes on next page)

Appendix II
Status of FAA'S Major Modernization
Projects

Legend

N/A = Not applicable.

TBD = To be determined.

^aTDLS is the Tower Data Link Services. TDLS I (Predeparture Clearance/Flight Data Input Output) has been commissioned at all 57 sites. TDLS II (Digital-Automatic Terminal Information Service) has been installed at 42 sites and commissioned at 23 additional sites. DLAP is the data link applications processor, which will interface between the National Airspace Data Interchange Network II and Host Interface Device/NAS Local Area Network.

^b The delay of the last-site implementation date is currently 6 years. The last-site implementation date has not been determined because of environmental issues at Ajo, Ariz.

^cASOS is one of three systems under the Automated Weather Observing System (AWOS) project, which also includes the Data Acquisition System (ADAS). AWOS achieved first-site implementation in 1989, and FAA has since commissioned 198 of the 200 AWOSs ordered.

^dThe date reflects the current estimate for the DSR project, initiated as part of the June 1994 restructuring of the Advanced Automation System into three distinct areas—en route, terminal, and tower automation.

^eIncluded in the total are the 11 additional Mode-S units that have been purchased under the Interim Support Plan.

^fThe last-site implementation date is indefinite.

^gThis project has been integrated into Air Traffic Management (ATM) which contains multisegmented projects. TATCA's functionality is contained within the Traffic Flow Management Functionality Development/Deployment project and the ATC Functionality Development/Deployment project.

^hThe date reflects the revised baselined schedule for STARS.

ⁱThe ASR-11 procurement, as part of the TRDRE program, provides 46 operational systems and 2 preproduction units to replace ASR-7s and equipment used at sites taken over from the Department of Defense. Future procurement requirements to either replace or upgrade the ASR-8s and provide for new establishments may increase the quantity from 48 to 112 systems but are still being evaluated and are pending approval.

^jThe project is currently under review.

^kThe schedule reflects the first phase of the project, when systems are scheduled to be installed in existing en route controller work stations. The last-site implementation date for the second phase of the project, when the system will interface with the DSR, is estimated in 2000.

^lThe project has been restructured into three stages since we reported on it in 1994.

^mThe date reflects the final stage or end-state of WAAS (E-WAAS), when it is scheduled to serve as a sole system for air navigation and landing guidance. Initial WAAS (I-WAAS) is scheduled to allow civil aircraft to use GPS domestically as a primary means of navigation in late 1998.

Summary of Costs and Schedules for FAA'S Major Modernization Projects

Project	Description and anticipated benefits	2-year comparison of total F&E cost changes (dollars in millions)			2-year comparison of first- and last-site implementation schedules		
		1996	1997	Change	1996	1997	Change
ADL	<ul style="list-style-type: none"> - Is a digital communications system that provides a variety of weather and ATC information between ground and airborne automation systems - Improves two-way air-to-ground communications and contributes to the system's safety and capacity by enhancing accessibility to information, relieving congested voice frequencies, and reducing workloads 	\$223.4	\$223.4	None	First-site: 8/95a 8/95a None Last-site: 5/00b TBD N/A <small>aDates for Tower Data Link Services. bDates for en route data link.</small>		
ARSR-4	<ul style="list-style-type: none"> - Provides for long-range surveillance radar, en route navigation, air defense, and drug interdiction - Decreases costs by replacing older radars that have become difficult to maintain and reduces number of site operators required 	409.7	415.7	+\$6.0	First-site: 2/96 4/96 +2 months Last-site: 8/97 TBD N/A		
ASDE-3	<ul style="list-style-type: none"> - Enables tower controllers to monitor ground movement of aircraft and other vehicles during periods of low visibility and darkness - Increases surface safety and capacity by replacing aging and less reliable radar equipment 	238.6	241.1	+2.5	First-site: 11/93 11/93 None Last-site: 11/99 11/99 None		
ASR-9	<ul style="list-style-type: none"> - Provides highly accurate monitoring of aircraft movement/position within a radius of 60 nautical miles of the airport terminal - Increases busy airports' safety by providing more accurate data (i.e. weather information) to separate and control the movement of aircraft in and out 	826.7	856.7	+30.0	First-site: 5/89 5/89 None Last-site: 5/98 5/98 None		
AWOS/ ASOS	<ul style="list-style-type: none"> - Obtains data such as wind velocity, temperature, altimeter setting, cloud height, and visibility - Processes and transmits weather data to pilots via a synthesized computer voice - Improves safety at small airports without towers and reduces observation errors at large airports 	255.4	313.4	+58.0	First-site: 7/89 7/89 None Last-site: 12/00 9/01 +9 months		
En route automation-- DSR	<ul style="list-style-type: none"> - Replaces hardware, software, and controllers' work stations at en route ATC facilities 	1055.3	1055.3	None	First-site: 10/98 10/98 None Last-site: 5/00 5/00 None		

**Appendix III
Summary of Costs and Schedules for FAA'S
Major Modernization Projects**

Project	Description and anticipated benefits	2-year comparison of total F&E cost changes (dollars in millions)			2-year comparison of first- and last-site implementation schedules		
ITWS	<ul style="list-style-type: none"> - Integrates data from terminal weather sensors such as TDWR and LLWAS to provide short-term automated weather information - Improves predictions of short-term weather changes in easily understood graphical and textual form, enabling air traffic personnel to isolate terminal area weather hazards and improve flight safety 	\$326.7	\$326.7	None	First-site: 11/00 4/02 +17 months Last-site: 3/02 7/03 +16 months		
Mode S	<ul style="list-style-type: none"> - Is a secondary surveillance radar that identifies, locates, and tracks aircraft by interrogating a device, called a transponder, on board the aircraft. Also provides a communication channel between the aircraft and ground facilities - Improves safety by locating aircraft more accurately than current secondary surveillance radar and expands capacity 	455	455	None	First-site: 3/94c 3/94c None Last-site: 12/98 2/99 +3 months <small>cDate for initial Mode S capability for terminal sites.</small>		
OAP	<ul style="list-style-type: none"> - Combines into a common system, hardware and software packages from various systems under development to improve the automation of ATC over the oceans - Improves traffic flow while promoting maximum fuel efficiency and minimal travel times 	236.5	237.5	+\$1.0	First-site: Indefinite 2/00 N/A Last-site: Indefinite 6/00 N/A		
OASIS	<ul style="list-style-type: none"> - Replace and enhance the current flight service automation system (FSAS) model 1 full capacity with a system that also integrates graphic weather display system functionality. The current M1FC system is becoming insupportable 	127.8	174.7	+46.9	First-site: Indefinite 7/98 N/A Last-site: Indefinite 12/01 N/A		
TATCA	<ul style="list-style-type: none"> - Provides controllers with several new automated tools to better sequence, space, and schedule time of arrival and departure of aircraft - Addresses present-day needs for increased airport capacity through the introduction of new technology and automation aids 	138	d	d	First-site: 12/96d d N/A Last-site: Indefinite d N/A <small>dProject has been integrated into Air Traffic Management which contains multi-segmented projects.</small>		
Terminal automation--STARS	<ul style="list-style-type: none"> - Replaces hardware, software, and controllers' work stations at terminal facilities 	940.2	940.2	None	First-site: Indefinite 12/98 N/A Last-site: Indefinite 2/05 N/A		
TDWR	<ul style="list-style-type: none"> - Detects hazardous weather around airports, such as microbursts, gust fronts, wind shifts, and precipitation - Promotes safety by providing alerts of hazardous weather conditions in terminal areas and of changing wind conditions that influence runway usage 	380.5	386.8	+6.3	First-site: 7/94 7/94 None Last-site: Indefinite Indefinite None		

**Appendix III
Summary of Costs and Schedules for FAA'S
Major Modernization Projects**

Project	Description and anticipated benefits	2-year comparison of total F&E cost changes (dollars in millions)			2-year comparison of first- and last-site implementation schedule		
		1996	1997	Change	1996	1997	Change
TRDRE	<ul style="list-style-type: none"> - Replaces aging analog systems with a digital radar signal output required for the successful implementation of STARS - Replaces ASR-7 radars with ASR-11 radars and upgrades or replaces the ASR-8 radar to provide digital output 	N/A	TBD ^e	N/A	First-site: N/A 1/00 N/A Last-site: N/A 9/04 N/A <small>^eFunding requirements to either upgrade or replace ASR-8 radars with ASR-11 radars are being evaluated.</small>		
Tower automation	Provides an infrastructure that will furnish an extensible open systems, standards-based platform on which to field surface movement advisories, new capacity, safety, and efficiency at a lower cost, with high reliability, and with common computer enhancements in human interface	\$259.2	f	N/A	First-site: Indefinite f N/A Last-site: Indefinite f N/A <small>^fProject currently under review</small>		
VSCS	<ul style="list-style-type: none"> - Replaces and improves voice ground-to-ground and air-to-ground communications at ATC facilities - Increases controllers' efficiency in handling air traffic 	1452.9	\$1452.9	None	First-site: 6/95 6/95 None Last-site: 5/00 5/00 None		
WARP	Will replace the existing Meteorologist Weather Processor (MWP) service and provide enhanced weather information to air traffic controllers, traffic management specialists, area supervisors, pilots, and the meteorologists who support them	N/A	125.8	N/A	First-site: N/A 9/97 ^g N/A N/A 9/99 ^h N/A Last-site: N/A 3/98 ^g N/A N/A 2/00 ^h N/A <small>^gStage 0--replacement of current equipment. ^hStage 1&2--interface with NEXRAD and DSR</small>		
WAAS	<ul style="list-style-type: none"> - Enhances GPS, a satellite-based system that provides precise time and position information to aircraft. Augments GPS signals to satisfy civil air navigation requirements in all phases of flight - WAAS benefits include increased operational safety, extensive user cost savings, reduced ground infrastructure costs, increased national airspace capacity, reduced aircraft separation, increased capability for precision approaches, simplified avionics, global standardization, and positive position location for air traffic management 	512.6	556	+\$43.4	First-site: 3/98 12/98 +9 months Last-site: 8/00 11/01 +15 months		

Source: FAA.

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